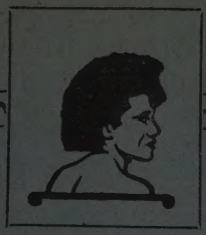
VOL. 19 NO. 1 JANUARY, 1948



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So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues published and those which are not now available is given for reference. Attention is especially directed to Volume 7 which had only one part:—

Vol.				*Vol.*			
1.	3	numbers,	1928.	10.	4	numbers,	1939 (none of Nos. 2 and 4).
2.	4	,,	1929.	11.	4	,,	1940 (none).
3.	3	,,	1930 (none).	12.	4	,,	1941 (none of Nos. 1 and 2).
4.	4	,,	1931.	13.	4	,,	1942.
5.	2	,,	1932 (none of No. 2).	14.	4	,,	1943.
6.	2	,,	1933.	15.	4	,,	1944.
7.	1	,,	1934.	16.	4	,,	1945.
8.	4	,,	1935–37 (none of No. 4).	17.	4	,,	1946 (none of No. 1).
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ISSUES OF THE AGRICULTURAL CIRCULAR.

NUMBERS and year of issue of the *Agricultural Circular* :—

Vol. 1, 1920, 12 numbers.
2, 1921, 5 ,,
3, 1922, 4 ,,
Vol. 4, 1923, 1 number.
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As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, No. 1.

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—EDITOR.

Agricultural Journal

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EDITORIAL . . .

LIVESTOCK NUTRITION IN THE TROPICS

In an article(1) *published in a recent issue of the* Agricultural Journal *the Animal Husbandry Officer drew attention to the improvement that could be expected in milk production by improved nutrition. Figures were quoted to show that, of the several factors that had contributed to the increase in production in New Zealand over the past ten years, fifty-seven per cent was due to this factor alone—adequate good quality high protein yielding pastures.*

These results have been achieved by scientific research applied to farming problems and have been facilitated by the active co-operation of research institutions agricultural colleges and above all the enlightened farming public of New Zealand who have been quick to appreciate the value of scientific research and to incorporate new ideas into existing farming practice.

The New Zealand work in grassland improvement and management has taken the line of strain selection in grasses and clover with the provision of certified seed; rotational grazing studies to determine the pressure that can be put on pastures without harm to yields and quality; cultural operations such as drainage, pasture renovation and manuring to maintain the succession of succulent species and to control weeds. Perhaps the greatest single factor in improved pastures was due to top-dressing with phosphates.

Fiji is a tropical country and has difficulties entirely its own. The central problem is one that is common to the tropics as a whole, which is the establishment and maintenance in good heart of a pasture comprising several species of grasses and legumes which give adequate protein for both maintenance and production. So far, although important work has been carried out in several tropical regions, little success has attended efforts to reproduce in the tropics the temperate country mixture of grasses and legumes which has been the principal factor in pushing up milk production.

It has been proved quite conclusively in Fiji, as in other tropical regions, that the good temperate country grasses and legumes cannot be established in competition with rough tropical growth. Many temperate species have been introduced and some do grow on experimental stations under ideal conditions. Work of this nature for Fiji has been reported(2). Thus successful establishment and growth in a tropical environment has met with failure.

The present tendency is to concentrate on tropical grasses and legumes and important work in this connexion has been carried out by Paterson and his pupils at the Tropical School of Agriculture, Trinidad. The work in other tropical territories has been closely followed by the Department of Agriculture and several important introductions of new grasses and legumes, and new strains of established grasses have been made and successfully established at Naduruloulou(3).

Many of the tropical grasses are not sufficiently high in protein content to maintain stock in adequate nutrition and their habit of growth renders it difficult to associate tropical legumes in mixed pasture. Several of the tropical legumes are excellent protein producers but their habit of growth either stifles associated grasses or they develop excessive wood and fibre with maturity, which affects their value as a source of protein.

Under present conditions the grassland farmer in Fiji is forced to use pure stands such as para, guinea, blue grass and the mixture of rough and sour grasses associated with hillside grazing and, as far as dairying is concerned, supplemented with coconut meal as a concentrate.

For the small farmer in the tropics the answer to better stock nutrition can be provided in terms of para, elephant grass and certain of the tropical legumes, including " vaivai ", which cut and hand fed as a balanced ration will provide adequate protein. Work at Naduruloulou and Sigatoka

has demonstrated that an adequate, well balanced and palatable ration can be provided by this means. The economics and practicability of the procedure are being tested at Sigatoka.

For the larger dairy farmer such procedures may not be practicable or economic and further research will be required to determine (*a*) the possibility of providing a grass-legume mixture which can be grazed under determined management conditions, (*b*) the practicability of a rotational grazing proposition involving pure legume stands and grass, (*c*) existing methods of grazing supplemented with cut legume stall-fed. This latter method which would to a greater or lesser degree reduce the need for expensive concentrate would in all probability require a fodder conservation programme to deal with the off season.

All this will take time before reliable and economic techniques can be worked out. This is a job for the technical officers of the Department and will require the facilities of agricultural stations when such are available.

In the meantime a lot has been accomplished by the practical farmer with existing grasses; a lot more however could be done to get the maximum out of existing grasses by more efficient management and attention to recognized farming practices.

On the advice of the Department of Agriculture, Fiji, supported by experts from Massey Agricultural College, New Zealand, the Manager of a local dairying concern has taken active steps to improve his para grass pastures and marked success has already attended his efforts. The work has involved:—

(*a*) drainage and replanting on areas where para had almost completely disappeared;

(*b*) the thorough discing of old para on well drained areas. Recovery and new growth is sufficiently rapid to suggest that this is the best method in renovating para;

(*c*) the subdivision of the area into 4-acre paddocks with carefully controlled rotation grazing at full pressure for a determined period;

(*d*) the mowing of old growth, which has a marked effect in stimulating young growth where recovery is required earlier than is possible with discing.

In another large area of the farm which was a mixture of sour grasses, carpet grasses, desmodium and weed, excellent weed control was effected by mowing; and there is little doubt that when conditions are suitable, mowing for weed control should form a feature of pasture management.

From soil analyses on the area it was found that soil nutrients, particularly phosphate, lime and nitrogen were in dangerously short supply and it is obvious that steps will have to be taken to meet this need. The nitrogen position can be rectified by the use of liquid manure and the incorporation of a green legume with the soil before grassing; the phosphate and lime needs will have to be provided by top dressing.

There is a growing awareness in Fiji of the need for fertilizers on our soils, particularly on the grasslands although it holds with equal force for the other agricultural regions of the Colony outside the sugar areas. It is not too much to say that unless fertilizers are used on the grasslands in adequate amounts serious difficulties may be encountered in the subsequent process of restoring fertility. The use of fertilizers and lime at reasonable prices is a pressing problem and one for which a solution must be found.

Farmers are faced with many difficulties in Fiji in the matter of grassland management, particularly during the present period of shortages, difficulties of acquirement and cost of fertilizers, agricultural equipment, fencing wire, etc. It is certain however that little improvement can be expected until management schemes such as have been outlined here are generally adopted.

The Department is doing all it can to push ahead with its inquiries directed to improve livestock nutrition which is the answer to greater butter-fat and milk production.

—W.J.B.

REFERENCES.

(1) Sanders, R. N., 1947.—"The Inadequacy of the Para Grass–Coconut Meal Mixture for Dairy Production", *Agricultural Journal*, Fiji, Vol. 18, No. 3, p. 73.

(2) Parham, B. E. V., 1934.—"Navuso Experimental Station—Annual Report 1934", *Annual Bulletin of Divisional Reports*, 1934, p. 50. (i) Annual Report of the Agricultural Officer, *Annual Bulletin of Divisional Reports*, 1933, pp. 8–9.

(3) Parham, B. E. V., 1947.—"Recent Plant Introductions", *Agricultural Journal*, Fiji, Vol. 18, No. 3, p. 77.

STAFF NOTES

Mr. F. M. Reid, Agricultural Assistant, resigned with effect from 2nd February, 1948.

Miss L. Duncan, Grade II Clerk, went on leave to Australia on the 29th February, 1948.

Mr. H. R. Surridge, Agricultural Officer, retired with effect from 6th March, 1948.

Mr. C. R. Vasey, Agricultural Assistant, returned from leave and resumed duty with effect from 1st March, 1948.

Mr. R. R. Mason, Agricultural Officer, assumed duty with effect from 20th January, 1948.

Mr. B. A. O'Connor was appointed Entomologist for a period of four years, with effect from 29th March, 1948.

Mrs. W. M. Gilmore was appointed Temporary Stenographer with effect from 22nd March, 1948.

Mr. D. J. G. Davies was appointed Live stock Officer with effect from 20th June, 1947.

R. S. Vera, Veterinary Assistant, was promoted to the post of Livestock Officer with effect from 1st March, 1948.

OVERSEAS VISITORS

Mr. A. J. Wakefield, C.M.G., a director designate of the Overseas Food Corporation, and Mr. G. H. Rushworth, Sydney manager of the Lever Bros. Pty. Ltd., visited Fiji early in March. Both spoke with emphasis at press conferences and over the radio of the desperate shortage of foodstuffs in a large part of the world to-day owing mainly to the great increase (160,000,000) in the world's population and to the widespread impoverishment of the world's soil through erosion. They urged that Fiji can contribute more by increasing the production of copra, groundnuts and other vegetable oil-producing crops and by the rehabilitation of neglected coconut plantations.

Mr. Wakefield advocated a strong copra-planters' association independent of the Government but co-operating with the Government in the setting-up of a reasearch station and some form of stabilization for the copra industry. As far as copra production in Fiji was concerned there was a certain future for the planter as there would be a world demand for copra for at least 20 years and the industry in Fiji could embark on a long-term policy.

—B.E.V.P.

PERSONAL NOTES

Mr. A. C. Barnes, C.M.G. (Director of Agriculture, Fiji, 1930–33) has recently been appointed Director of Research, Sugar Manufacturers' Association (of Jamaica) Ltd., Jamaica.

Mr. R. Johns, O.B.E. (Agricultural Officer, Fiji, 1939, has succeeded Mr. A. J. Wakefield C.M.G., as Agricultural Adviser to the Development Commissioner of the British West Indies.

Professor C. Y. Shephard who, as many readers will remember, visited Fiji in 1944 to report on the Sugar Industry and who also planned a reorganization for the Department of Agriculture, Fiji, was awarded the C.B.E. in the New Year's Honours List.

Manasa B. Tauca (Field Assistant, Department of Agriculture, 1930–34) who is now Managing Director of the Fijian Co-operative Marketing Association Ltd., was awarded the British Empire Medal in recognition of the contribution made during the war and since by the organization which he represents.

AGRICULTURAL SCHOLARSHIPS.

The Principal, Lawes Agricultural College, has reported that the three Fijians who are at present taking a Diploma course at the College were successful in passing their examinations at the end of the year. In January, Ilisoni Cokanasiga, Veterinary Assistant, was granted leave of absence for the purpose of attending the same College.

RICE EXPERIMENTS

I. FERTILIZER TRIALS

BY M. D. FFRENCH-MULLEN

[The following article is the first of a series dealing with experimental work on the cultivation of rice organized by the Research Committee of the Department of Agriculture.

The object of this experiment was to determine the response of "Leaf Yellows" disease of rice to dressings of various manures available at the time and of lime in the form of coral sand; as well as the response of the rice variety "China Patna" to dressings of these manures and lime.

The opportunity occurred also to obtain observations on the effectiveness of Cryocide sprays and baits on the control of army and cut worm as compared with paris green baits. Ed.]

LAY-OUT AND TREATMENTS.

A randomized block lay-out was decided upon containing six replications with ten treatments. Plots 50 links by 50 links (equivalent to 1/40th of an acre) were laid out with five-link guard rows. The treatments in each block were randomized and were as follows:—

Treatment A.

Complete fertilizer, 22·4 lb broadcasted per plot, equivalent to 8 cwt. per acre.

Treatment B.

Complete fertilizer, 22·4 lb broadcasted per plot, equivalent to 8 cwt. per acre, plus minor elements applied dissolved in water in the form of a spray at the following rates per acre: Copper sulphate, 5 lb; manganese sulphate, 2 lb; zinc sulphate, 1 lb; boron, 2 lb; ferrous sulphate, 2 lb. The required amount of each minor element compound for each plot was weighed out, dissolved and bottled separately in the Chemical Laboratory. The various solutions were mixed in a sprayer immediately prior to application and additional water added to obtain an effective cover of each plot. There was no sign of precipitation when the solutions were mixed in the sprayer.

Treatment C.

A complete fertilizer, 22·4 lb broadcasted per plot, equivalent to 8 cwt. per acre plus 168 lb of coral sand broadcasted per plot, equivalent to three tons per acre.

Treatment D.

Complete fertilizer, 5·6 lb broadcasted per plot equivalent to 2 cwt. per acre.

Treatment E.

Superphosphate, 11·2 lb broadcasted per plot, equivalent to 4 cwt. per acre.

Treatment F.

Superphosphate, 11·2 lb broadcasted per plot, equivalent to 4 cwt. per acre plus farmyard manure, 5 cwt. broadcasted per plot, equivalent to 10 tons per acre.

Treatment G.

Farmyard manure, 5 cwt. broadcasted per plot, equivalent to 10 tons per acre.

Treatment H.

Coral sand, 168 lb broadcasted per plot, equivalent to 3 tons per acre.

Treatment I.

Ammonium sulphate, 5·6 lb broadcasted per plot, equivalent to 2 cwt. per acre.

Treatment J.

Control.

SITE.

The area chosen for the experiment of slightly less than two acres was situated in the Kasavu river valley close to the Model Farm rice areas of Naduruloulou. The soils of the area were considered to be of uniform type having been mapped as belonging to the Kasavu colluvial soil series.

The area to be utilized had grown the rice variety "China Patna" for the two previous seasons (1943–44 and 1944–45). In the former season no "Leaf Yellows" disease was recorded and the yield of padi was reported to be 30 bags from 2½ acres of rice. In the 1944–45 season, the rice planted on the area was severely attacked by "Leaf Yellows" and the yield from the

same acreage was 15 bags. Prior to the 1943–44 season, various rice varieties had been grown for many years on the land.

AGREEMENT WITH FARMER.

An agreement was made with Jokhan, f/n Sukhlal that, in return for the use of a section of his farm on which he was going to grow rice, the Department of Agriculture would guarantee him against loss by handing over to him the rice crop after harvest and if the harvest from the experiment was less than the average for the surrounding farmers' crops, the difference in weight of padi would be made up. The farmer agreed also to work with his family without wages in all farming operations required by the experiment. This arrangement worked quite satisfactorily.

WEATHER CONDITIONS.

Weather conditions were favourable to late planted crops throughout the growing period. The experiment was flooded once during a period of heavy rain. The incidence of " Leaf Yellows " disease throughout the division was less than in the previous season owing to favourable rains. The weather at harvest was good permitting the grain to mature and no rain was experienced during harvesting.

CULTURAL OPERATIONS.

It had been decided that all cultural operations should be similar to the operations carried out by the majority of Indian peasant farmers. The farmer, therefore, ploughed his land early using his own implements and bullocks. At the end of January the area was cross ploughed and after the first heavy rains was harrowed preparatory to planting. The area was laid out early in February and the manurial treatments broadcasted and lightly forked in over the period 6th to 7th February. The transplanting of " China Patna " seedlings commenced on the 6th of February and was completed on the 9th of February, the guard rows remaining until the last. The application in the form of a spray of minor elements, part of treatment B, was carried out on the afternoon of the 20th of February. The seedlings used were grown by three peasant farmers in their own nurseries. Forty-two plots were planted with seedlings reported to be seven weeks old and 18 plots with seedlings said to be five weeks old as judged by growth, all seedlings appeared to be of similar age. Three to five seedlings were planted at each stool as is customary.

One weeding was done over the period 15th to 26th of March. Several plots were infested with water hyacinth which retarded growth. Other weeds found were tar weed, muraiana and other grasses.

The recording of " Leaf Yellows " disease attack and observations made on control methods for army and cut worms will be dealt with under separate headings below.

The harvesting as well as all cultural operations were carried out in the main by Indian labour, themselves peasant farmers The guard rows were harvested on the 3rd of June, threshed and the weight of grain recorded prior to air drying. Blocks 1, 2 and part of Block 3 were harvested and threshed on the 4th of June and the weight of straw after threshing and of padi was recorded for each plot. On the 5th of June the remainder of the experiment was harvested and threshed and the weight of straw and padi recorded for each plot. The padi from each plot was air-dried and hand-winnowed and the weight of clean, air-dry padi was recorded on the 10th of June, 1946.

MANURES AND FERTILIZERS.

The makers of the complete fertilizer applied claimed that it contained six per cent nitrogen, nine per cent available phosphoric acid and six per cent water soluble potash. The minor elements used were obtained from laboratory stocks. The superphosphate was obtained from local commercial stocks as was the sulphate of ammonia. The farmyard manure was produced at the Model Farm of the Department of Agriculture and was well rotted and in prime condition. The coral sand was supplied by the Colonial Sugar Refining Company Limited from stocks and was a fair sample of sand that is applied to sugar cane fields.

RESULTS—MANURIAL TREATMENTS.

The total net weight of sun-dried, clean padi obtained was 1 ton, 12 cwt., 1 qr., 2 lb being made up of 2,816 lb from all plots and

798 lb from the guard rows. The total net weight of straw weighed immediately after threshing was 4 tons, 13 cwt., 3 qr., 21 lb being made up of 8,125 lb from all plots and 2,396 lb from guard rows. The padi and straw yields for each plot are shown in Table 9, together with treatment means and block means.

(*a*) *Padi.*

TABLE I—ANALYSIS OF VARIANCE.

	D.F.	S.S.	Variance.	"F test" calculated
Total ..	59	5,101·23	.....	.....
Treatment ..	9	979·73	108·858	2·38
Block.. ..	5	2,060·78	412·156	9·00
Error ..	45	2,060·72	45·794	.....

The Table of F for 9 and 45 degrees of freedom and P = 0·05 records a reading of F = 2·10. The calculated value of F (see Table 1) exceeds this, so that the difference between treatments is significant. The Table of F for 5 and 45 degrees of freedom and P = 0·05 records a reading of F = 2·41 and for P = 0·01 a reading of F = 3·46. The calculated value of F (see Table 1) exceeds either of these so that the difference between blocks is not only significant but is highly significant.

The standard error of the difference between the mean padi weights of the various treatments is:—

$$\frac{\sqrt{45{\cdot}794 \times 2}}{6} = 3{\cdot}91$$

The reading of t for 45 degrees of freedom at P = 0·05 is 1·95996. Therefore differences between treatment means greater than 7·66 are significant.

TABLE 2—PLOT YIELDS (PADI).

Treatment.	Mean Weight of padi in lb.	Difference from Control.
H (Coral sand, 3 tons) ..	55·33	+ 8·83
C (Complete fertilizer + coral sand)	49·67	+ 3·17
E (Superphosphate, 4 cwt.) ..	49·58	+ 3·08
D (Complete fertilizer, 2 cwt.)	47·67	+ 1·17
F (Superphosphate + farmyard manure)	47·17	+ 0·67
J (Control)	46·50	.....
G (Farmyard manure) ..	45·75	— 0·75
B (Complete fertilizer + minor elements) ..	45·25	— 1·25
I (Ammonium sulphate) ..	43·17	— 3·33
A (Complete fertilizer, 8 cwt.)	39·25	— 7·25

The application of coral sand at a rate of three tons per acre resulted in a significantly higher yield of padi at the P = 0·05 point. No other treatment significantly increased or decreased the yield of padi.

The application of 8 cwt. per acre of the complete fertilizer used, markedly depressed yields as did the application at the rate of 2 cwt. per acre of sulphate of ammonia but to a lesser degree. The application of complete fertilizer at a rate of 8 cwt. per acre together with coral sand at a rate of three tons per acre increased yields to the same apparent degree as an application of superphosphate at a rate of 4 cwt. per acre. The slight depression of yields which occurred when minor elements were applied in addition to complete fertilizer at a rate of 8 cwt. per acre is of interest.

The standard error of the difference between the mean padi weights of the various blocks is:—

$$\frac{\sqrt{45{\cdot}794 \times 2}}{10} = 3{\cdot}02$$

The reading of t for 45 degrees of freedom at P = 0·05 is 1·95996 and at the P = 0·01 is 2·57582. Therefore, differences between block means greater than 5·92 at the P = 0·05 point and 7·78 at the P = 0·01 point are significant or highly significant.

TABLE 3—BLOCK YIELDS (PADI).

Block.	Mean weight of padi. in lb.	Difference from previous value.
5	55·20	...
6	51·70	3·50
4	48·10	3·60
3	47·55	0·55
2	40·85	6·70
1	38·20	2·65

Blocks 3—6 inclusive are significantly better than Block 1 at the P = 0·01 point and Blocks 5 and 6 are significantly better than Block 2 at this point. Blocks 3 and 4 are significantly better than Block 2 at the P = 0·05 point.

(*b*) *Rice Straw.*

TABLE 4—ANALYSIS OF VARIANCE.

	D.F.	S.S.	Variance	"F test" calculated
Total ..	59	40,682·58	.....	.....
Treatment ..	9	9,988·75	1,109·86	2·17
Block.. ..	5	7,686·28	1,537·26	3·01
Error ..	45	23,007·55	511·28	.....

The Table of F for 9 and 45 degrees of freedom and P = 0·05 records a reading of F = 2·10. The calculated value for F (see Table 4) exceeds this so that the difference between treatments is significant. The Table of F for 5 and 45 degrees of freedom and P = 0·05 records a reading of F = 2·42. The calculated value for F (see Table 4) exceeds this so that the difference between blocks is significant.

The standard error of the difference between the mean straw weights of the various treatments is:—

$$\frac{\sqrt{511{\cdot}28 \times 2}}{6} = 13{\cdot}06$$

The reading of t for 45 degrees of freedom at P = 0·05 is 1·95996. Therefore differences between treatment means greater than 25·60 are significant.

TABLE 5—PLOT YIELDS (STRAW).

Treatment.	Mean weight of straw in lb.	Difference from Control.
H (Coral sand, 3 tons) ..	161·17	+ 36·17
C (Complete fertilizer + coral sand)	144·67	+ 19·67
E (Superphosphate, 4 cwt.)..	144·17	+ 19·17
F (Superphosphate + farmyard manure)	141·17	+ 16·17
G (Farmyard manure) ..	137·17	+ 12·17
I (Ammonium sulphate) ..	132·17	+ 7·17
D (Complete fertilizer, 2 cwt.)	131·67	+ 6·67
B (Complete fertilizer + minor elements).. ..	125·50	+ 0·50
J (Control)	125·00	.....
A (Complete fertilizer, 8 cwt.)	111·50	— 13·50

The application of coral sand at a rate of three tons per acre resulted in a significantly higher yield of straw as compared with the control at the P = 0·05 point. No other treatment significantly increased or decreased the yield of straw.

The standard error of the difference between the mean straw weights of the various blocks is:—

$$\frac{\sqrt{511{\cdot}28 \times 2}}{10} = 10{\cdot}11$$

The reading of t for 45 degrees of freedom at P = 0·05 is 1·95996. Therefore differences between block means greater than 19·82 are significant.

TABLE 6—BLOCK YIELDS (STRAW).

Block.	Mean weight of straw in lb.	Difference from previous value.
5	145·60	...
6	145·30	0·30
4	144·20	1·10
3	137·70	6·50
1	120·20	17·50
2	119·50	0·70

Blocks 4–6 inclusive are significantly better than Blocks 1 and 2.

To summarize, it was found that the application of coral sand at a rate of three tons per acre to soils of the Kasavu colluvial series resulted in a significantly higher yield of both padi and straw of the rice variety "China Patna" at the five per cent point during the 1945–46 rice season. Further, a significant difference was found between blocks both for padi and straw weights.

"LEAF YELLOWS" DISEASE.

Weather conditions were favourable to rice during the 1945–46 growing season. As a result, although the experiment under review was planted late, the general incidence of "Leaf Yellows" was slight and of short duration. The observations made are summarized in Table 7 below.

TABLE 7—(INCIDENCE OF "RICE YELLOWS" DISEASE).

Date.	No symptoms per cent of plots.	Slight symptoms per cent of plots.	Slight to moderate symptoms, per cent of plots.	Moderate symptoms per cent of plots.	*Sogata furcifera* per cent of all plots infested.
11/3/46 ..	33·3	66·6	..	..	100
18/3/46 ..	..	65·0	28·4	6·6	100
2/4/46	35·0	65·0	..	..	5

On the 11th March, 66·6 per cent of all plots showed slight symptoms of "Leaf Yellows" but in 77·5 per cent of the plots with symptoms, the symptoms were confined to plants growing in slight depressions within the plot. The presence of stagnant water in the majority of these depressions was noted.

The manures and lime applied had no apparent effect on the incidence of "Leaf Yellows" disease of rice.

PESTS.

(*a*) *Army and Cut Worms.*—During the course of this experiment, attacks of army and cut worms were experienced. The opportunity was taken to try out the effectiveness of cryocide as a bait and as a spray compared with paris green baits.

An outbreak of medium intensity of army and cut worms occurred at the end of March following heavy rains and flooding. All plots were sprayed in the late afternoon with a Cryocide spray of 1 oz. to 1 gallon of water plus white oil as a sticker and spreader. Light showers of rain were experienced on the second night following the application. The kill of caterpillars was very small being non-effective.

Following the failure of the spray, the field was quartered and four baits were broadcasted by hand in the late afternoon of the 11th of April in fine weather as follows:—

TABLE 8—(CUTWORM CONTROL).

Area.	Bait.
Blocks 4—6, Plots 1—5 ..	Paris Green 1 lb
	Rice Bran 25 lb
	Molasses .. 2 quarts
	Water .. 2 gallons
	Lemons .. Juice of 6
Blocks 4—6, Plots 6—10..	Cryocide .. 3 lb
	Rice Bran.. 25 lb
	Molasses .. 2 quarts
	Water .. 2 gallons
	Lemons .. Juice of 6
Blocks 1—3, Plots 1—5 ..	Cryocide .. 1 lb
	Rice Bran.. 25 lb
	Molasses .. 2 quarts
	Water .. 2 gallons
	Lemons .. Juice of 6
Blocks 1—3, Plots 6—10 ..	Cryocide .. 2 lb
	Rice Bran.. 25 lb
	Molasses .. 2 quarts
	Water .. 2 gallons
	Lemons .. Juice of 6

The weather remained fine throughout the next two days. The paris green bait resulted in a 90 per cent kill overnight and complete control at the close of the second night. The Cryocide baits were found to be much less effective to useless. The bait containing 3 lb of Cryocide gave an estimated kill of 30–40 per cent while the bait containing 2 lb resulted in a kill of less than 20 per cent while the bait containing 1 lb was non-effective.

With the failure of the Cryocide baits, a paris green bait prepared to the same formula as previously used was broadcasted at the same rate over the whole experiment and complete control of these pests was recorded on the 21st of April.

It appears, therefore, that Cryocide would be of no use in the control of army and cut worms in the concentrations tried. A bait with a greater proportion of Cryocide than used in the baits mentioned might be more effective but such a bait would be more costly to use than a paris green bait made to the formula recorded above.

(*b*) *Leaf Rolling Caterpillar.*—A slight attack of this pest was recorded in April but the intensity of infestation did not warrant the application of control measures.

TABLE 9—YIELDS OF PADI AND STRAW.

Treatment.	Blocks.												Treatment.			
	Padi 1.	Straw 1.	Padi 2.	Straw 2.	Padi 3.	Straw 3.	Padi 4.	Straw 4.	Padi 5.	Straw 5.	Padi 6.	Straw 6.	Padi Total.	Straw Total.	Padi Mean.	Straw Mean.
A	27	65	40	106	38	109	34	97	63	184	33·5	108	235·5	669	39·25	111·50
B	35	98	27	129	36·5	103	58	160	63·5	137	51·5	126	271·5	753	45·25	125·50
C	52	145	42	111	48·5	182	44	143	55	145	56·5	142	298	868	49·66	144·66
D	47	154	39·5	92	49	142	47	115	53·5	139	50	148	286	790	47·66	131·66
E	37	104	53	149	45·5	127	47	153	55·5	144	59·5	188	297·5	865	49·58	144·16
F	36	107	46	134	45·5	160	49	150	50	127	56·5	169	283	847	47·16	141·16
G	31·5	127	36	95	43·5	113	52·5	185	56·5	155	54·5	148	274·5	823	45·75	137·16
H	48	179	55·5	155	60·5	158	59·5	180	57·5	145	51	150	332	967	55·33	161·16
I	30	117	31·5	123	54·5	142	41	127	50	150	52	134	259	793	43·16	132·16
Control ..	38·5	106	38	101	54	141	49	132	47·5	130	52	140	279	750	46·50	125·00
Total ..	382·0	1202·0	408·5	1,195	475·5	1,377	481·0	1,442	552·0	1,456	517·0	1,453	2816·0	8,125	....	....
Mean ..	38·20	120·20	40·85	119·50	47·55	137·70	48·10	144·20	55·20	145·60	51·70	145·3	....	....	....	....

NB—(A) The weight of padi is the sun-dried net weight after hand winnowing, recorded in lb.
(B) The weight of straw is the net weight taken after threshing had been completed, recorded in lb.

SUMMARY OF CONCLUSIONS.

(*a*) The application of lime in the form of coral sand at a rate of three tons per acre resulted in a significant increase in the weight of padi and rice straw of the rice variety "China Patna" grown on soils of the Kasavu colluvial series as compared with the control on which neither manure nor coral sand had been applied.

(*b*) There were significant differences in block yields for both padi and rice straw.

(*c*) The manures and coral sand applied had no observed effect on the incidence of intensity of attack of "Leaf Yellows" disease.

(*d*) Cryocide baits and a spray at the concentrations used were not as effective as the paris green bait used in the control of army and cut worms attacking rice.

ACKNOWLEDGMENTS.

The assistance of Field Assistants, Salimoni Rokonaca, Filimone Raiqiso, Ram Nath and Uraia Koroi, all of whom were concerned with some phase of the work involved is gratefully acknowledged. Coral sand and sulphate of ammonia were made available by the Colonial Sugar Refining Company Ltd. Lastly, the co-operation of Jokhan, f/n Sukhlal is acknowledged as without the use of a section of his farm this work could not have been carried out.

THE FARMERS' CREED

We believe in small farms and thorough cultivation as against land hunger.

We believe that soil loves to eat as well as its owner and ought therefore to be fed liberally.

We believe in large crops which leave the land better than they found it, make the farmer and the farm both glad at once.

We believe that every farm should own a good farmer.

We believe that the best fertilizer for any soil is a spirit of industry, enterprise and intelligence; without this, lime and gypsum, bones and green manure, marl and guano will be of little use.

We believe in good fences, good barns, good farm houses, good stock, good orchards, and children enough to gather in the fruit.

We believe in a clean kitchen, a neat wife in it, a spinning wheel, a clean cupboard, a clean dairy, a clean conscience, and a clean deal.

(Reprinted from the Journal of the Department of Agriculture, of South Australia, Vol. LI, No. 8, p. 400.)

CORRESPONDENCE.

The Editor,
Agricultural Journal, Suva.

Dear Sir,

Your editorial note to my article "The Inadequacy of the Para Grass–Coconut Meal Mixture for Dairy Production" in the September issue of the *Journal* may be misleading to some readers.

The only grass mentioned in the article was Para grass. This was because Para is commonly used in Fiji and is inferior to many other grasses in digestible protein content. The article neither stated nor intended to imply a general condemnation of all grasses for milk production. Similarly it was not in support of universal feeding of concentrates as suggested in your note.

There is a great seasonal fluctuation of production of butterfat in Fiji. The figures quoted by you represent a rise of 27 per cent. Season fluctuation in Fiji, without change of pasture or feed, may amount to a fall and rise of up to 60 per cent. The rise in production mentioned by you might have occurred on the original pasture as the season advanced, without supplementary feeding or change of pasture.

Yours faithfully,

R. N. SANDERS,
Animal Husbandary Officer.

25/2/48.

AGRICULTURAL NOTES . . .

1 FOOD LOSSES CAUSED BY INSECTS AND MOULD FUNGI

The world food crisis, which seems to be as critical as ever, calls for the utmost effort on the part of farmers and of all concerned with the production and handling or transport of food.

There are only two ways of increasing the overall supply of food; one is to step up production, and the other is to save food. An important contribution to the latter is the prevention of loss, and one extremely important source of preventable loss is the activities of insects, mites, mould and rodents. These destroyers of food work ceaselessly and the annual loss in cereals, pulses and oil seeds alone has been estimated by experts to be ten per cent of production for the entire world, representing a quantity of food sufficient to supply the major part of the food requirements of 360,000,000 adult persons.

One example of this form of loss is provided by the copra industry in Fiji. It is well known to all associated with this industry that mould and the copra " bug " between them cause the serious deterioration of copra, causing it to become discoloured and, if left long enough, to break down with the production of a large amount of dust. It is also well known that the activity of mould and insects in copra is encouraged by a high moisture content and that copra which is properly dried to a moisture content of six or seven per cent suffers little if any breakdown.

However in the controversy as to whether or not the improvement of quality of copra through better drying is or is not worth while, the emphasis has always been on quality, and whether or not the higher price obtainable for good copra is sufficient to offset the additional cost of drying copra under adverse climatic conditions. Consideration of quantity is usually neglected and it is not generally realized that the loss to the producer in making low grade copra may be heavy indeed, much more so than is represented by the insignificant price margin between Plantation grade and F.M.S.

As long ago as 1927(1) the then Government Chemist of the Fiji Department of Agriculture (Mr. Colin Southall) undertook investigations into the loss of weight of copra when dried under varying conditions. The result of these investigations showed that copra dried to 8·8 per cent of moisture (and far too much Fiji copra has a higher water content than this at the present time) could lose nine per cent of its dry weight by the time it had been stored for six weeks, while if drying conditions were poor at the time the copra was on the " vatas " and the moisture content was 15 per cent when it was taken into store, then the loss of dry copra could be 20 per cent, or one-fifth of its total weight. It is emphasized that these figures give the actual loss of dry copra, not the ordinary shrinkage due to slow drying out.

It is not possible to calculate with any degree of accuracy the actual loss to Fiji producers (and to the Copra Board in the case of copra sold to the Board soon after manufacture) from this source of preventable loss because there is so much variation in quality. But quality has deteriorated during the present period of high prices and if the low average figure of five per cent of preventable loss is taken this would represent 1,700 tons of copra on the 1947 production which was 34,916 tons. In money value, at present prices (say £40 on the plantation) it represents £68,000 so that producers could afford to spend some £50,000 a year on improved drying of copra, thereby making a larger contribution to world food supplies, and still leave themselves well on the right side of the ledger.

—C.H.

REFERENCE.

(1) Southall, Colin L., 1928.—" Deterioration of Copra on Storage." *Agricultural Journal*, Fiji, Vol. 1, No. 3, p. 29.

2. BANANA CULTURE

The maintenance of the Fijian banana industry rests on the production and export of first-class fruit for overseas markets. New Zealand receives supplies of bananas from Samoa (a dependency) and Tonga, as well as from Fiji. It is only natural that Samoa should be given preference over Fiji. To compete in the New Zealand banana trade only first class fruit must be shipped to that country. Similarly if the Canadian trade for bananas on the bunch is to be revived, well g own, large-handed bunches must be produced for export. Growers have recently experienced the severe grading imposed by Inspectors at the packing stations. An endeavour has been made to explain to the growers the position Fiji is placed in with regard to the export of bananas to New Zealand, but until really good fruit is produced this drastic culling out of scabby, undersized fruit must continue.

The production of quality fruit requires attention to (1) improved cultivation methods, and (2) control of pests—particularly scab moth.

The banana plant, like any other fruit tree, will only produce good bunches of fruit when it is properly planted, weeded, cultivated, pruned, and protected against the attacks of insects and disease. Therein lies the way to the production of large, even, disease-free bunches of bananas, which the Canadians and New Zealanders will be anxious to buy. The following notes explain briefly how good crops of bananas can be produced.

SELECTION OF SUCKERS.

First there is the selection of planting material which is very important indeed. Whatever part of the banana corm is used for planting material, it must be taken from shoots that are free from disease and beetle borer, and plants that have given big bunches of bananas. If suckers are used these should be at least four inches across at their widest part and about 18 inches long. Suckers with sword-shaped leaves are the best. When the sucker is removed from the parent plant it is necessary to cut off the roots and trim the base square so that it will sit upright in the hole at planting time. A banana butt, which consists of the corm and part of the stem of a plant that has borne a bunch, is very good planting material, and plants grown from butts generally bear fruit much earlier than those grown from suckers. When preparing a butt for planting, the base of the corm should be squared off, and the stem cut off about 10 inches above the corm and all roots cut off. Should the corm show signs of weevil infestation, the outer covering of the corm should be pared off as well. Only two prominent buds should be left on the butt, the rest being gouged out. Bits of butts, which consist of a section of corm containing one or more buds, can be used for planting, but they are often killed in dry weather after planting.

PLANTING.

To grow properly a plant should have plenty of space and sunshine. It is very necessary that bananas are well spaced, and so no bananas should be planted closer than $10' \times 10'$, and for preference $12' \times 12'$. When digging the holes for the suckers, make the holes at least 18" square and about 15" deep, so that, when the plant is in position, there is plenty of broken up soil to place around it, into which it can send its new roots. It is a very bad mistake to dig a hole just big enough to take the sucker or butt. It is not necessary to fill the hole right up when the plant is put in. About four to six inches of top soil is placed around the plant, packed firm, and then covered with a thin layer of loose soil. The rest of the soil can be filled in as the plant grows. Until the plantation becomes established it is of the utmost importance that no weeds be allowed to grow, especially in the early stages of the banana's growth. This means that for the first year four or five thorough chippings will be necessary, and if the soil is of a heavy type, the whole plantation will need grubbing to a depth of six inches. If the plantation is well cared for in its first year of growth, the work for the following years becomes much easier.

PRUNING.

If bananas are not desuckered they will produce an abundance of suckers, which means that a stool of bananas is crowded out with spindly plants producing a number of very poor grade bunches. To produce good bananas it is essential that the plants be properly desuckered. Of the three recognized systems, the following system may be adopted with success:—

This system consists of allowing the plant only to grow for four months, then allowing one sucker to develop alongside. All other suckers are removed until four months later, another sucker is permitted to develop on the opposite side. At the end of another four months a third sucker is allowed to develop alongside of the first sucker, and so on. By following this method of pruning, one developed bunch only is permitted to hang on each stool at one time, and as the plant is putting its energy into this bunch, it will be a good one, and worth more than two or three smaller bunches. When selecting a sucker to follow on as a plant, never take one that does not develop from low down at the base of its parent. The sooner unwanted suckers are removed the less exhaustion there is to the plants that are to produce the fruit. Frequent inspections for disease should be made and plants affected with "Bunchy-top" should be sprinkled or sprayed with kerosene in the heart leaves, dug out, and destroyed by burning.

HARVESTING.

When cutting a bunch of bananas, never let the bunch drop to the ground, this bruises the bananas. It is just as easy to cut the bunch and let it down to the ground gently. Cut bunches should always be stacked upright and kept out of the sun. At the packing station, hands of bananas should be cut from the bunch and not torn off. Likewise, all excess wood should be cut off the hand before each banana is stripped off, otherwise bruising of the butt end of the banana occurs.

PEST CONTROL.

The cultivation of the banana having been dealt with, attention is necessary to the urgent need for pest and disease control, with particular stress on the seriousness of the scab-moth in all areas. The majority of the bananas rejected are scabby bananas resulting from the ravages of this moth; unless this pest is controlled, large losses will continue no matter how well the bananas are cultivated.

The scab-moth can be controlled by the use of pyrethrum powder applied at the right time. This pale-yellow moth with a few black speckles lays its eggs under the bracts which are the coverings over the young undeveloped hands of bananas. The "grubs" soon hatch out and scar the bananas with their chewing. It is therefore necessary to apply this dust with a blower as soon as the banana flower stalk commences. The bracts covering over the hands are lifted and the dust blown into the spaces between the bananas by means of a hand blower. The blower and pyrethrum are obtainable in Sigatoka or Suva. The pyrethrum powder is mixed with two to three parts of wood ashes for every part of pyrethrum. This mixture is then put in the blower and dusted into the young banana's hands. Do not mix up too much ashes and powder at one time. Any powder left over should be kept in a closed tin. To be sure of good fruit every bunch in the plantation should be dusted.

The banana beetle-borer is also a very serious pest. This insect causes the bananas to cease bearing in two or three years instead of producing good bananas for six or seven years. Also the bunches from bananas infested with borer are much smaller. The banana borer lays its eggs just under the "skin" of the plant at ground level. In about ten days they hatch out and the grubs bore into the centre of the plant and make holes or tunnels all round the centre. After it has fed enough it comes to the surface layer of the plant and there develops into a beetle after which it eats its way out of the plant. To control this pest the following methods can be applied.

(1) By selecting clean suckers and planting these during January in a separate area. The multiplied suckers from this "clean" area are removed in August or September and planted out into the plantation.

(2) Good strong suckers at least nine inches in diameter above the butt must be selected, having one, or more, undeveloped lateral eye in addition to the aerial stem which is cost off short (about 18 inches). The centre shoot is not allowed to grow so that one of the lateral eyes develops, producing in 12 months a bigger and better bunch than would have been the result had the sucker itself grown.

(3) Banana weevil-borer can be poisoned in the following manner.

Infested plantations should be regularly baited, and for this purpose one part of paris green mixed dry with six parts of flour by weight is the insecticide generally employed. This poison mixture may be dusted on the baits through the finely perforated lid of a half-pound cocoa tin. When desuckering commences the newly-cut surfaces of the parent corms should be dusted with the paris green and flour mixture, and the butts of the sucker eyes or suckers, may be sliced off and replaced in position after being dusted with the mixture. Stems from which the bunches have been cut should be chopped down at not more than six inches from the ground and split open to facilitate rapid drying, thus rendering the tissue unsuitable for the breeding of the banana weevil borer. The butt left after the cutting down of the spent stem must be poisoned whenever weevil borer is present. This can be accomplished by cutting the butt at or near the level of the ground thus forming a slab a few inches thick. The cut surfaces should then be dusted and slab replaced with a small stick or stone between the slab and the remaining part of the butt. The beetles are readily attracted to the baits made as described, but care must be taken to ensure that there is only a thin, even dusting of the cut surfaces. Heavily dusted surfaces will not be attractive to the beetles, while too-lightly dusted baits will permit the beetles to feed without being poisoned. The period of attractiveness of the baits will be considerably prolonged by covering them with a little trash.

Paris green is obtainable from the Department of Agriculture.

PACKING FOR SHIPMENT.

It is essential to make shipments as regular and uniform as possible. The shipping at present is not adequate but it is the responsibility of both shippers and growers to see that full cargoes of bananas are, where possible, loaded on every occasion a vessel is shipping this fruit from Fiji. The banana packer and shipper, and the growers should co-operate in the filling of the quota allotted for their area. This can be achieved by the shipper making distribution of banana cases to each packing area in advance of the packing days, and an exact understanding made between shipper and growers as to the day and time the packing is to be done in any area. It is the duty of the packer to notify the growers of cutting dates as soon as possible. It is the responsibility of the "Turaga-ni-koro" of each village to advise the people of his village of any information concerning banana shipments which has been issued to him from the Provincial Administration.

Should the quantity of bananas for a banana area repeatedly fall short of the quota allotted for shipment, then there is every possibility that this quota will be drastically reduced, resulting in loss of trade for the shipper, loss of market for the growers, and a general set-back to the provinces.

—C.E.W.

3. COUNTRY MARKETS

The Government scheme for the establishment of country markets has made good progress. To date buildings have been erected at Nadi and Sigatoka and others are in process of construction at Nausori, Ba and Labasa. The structures are substantially built with concrete floors, steel frame and fibro-cement roofing. Each building is equipped with a lock-up space for the overnight storage of produce and tables are available for the use of vendors. The buildings at Nadi and Sigatoka are single units with approximately 2,300 square feet floor space—that at Nausori is a large unit with approximately 5,000 feet floor space.

Regulations governing the operation of these markets have now been published and are administered by the local authority or the local Township Board as the case may be.

—B.E.V.P.

4. CO-OPERATIVE SOCIETIES

With the publication late in December, 1947, of the Regulations of the Co-operative Societies Ordinance No. 11 of 1947 it has been possible to commence the work of investigating applications and arranging for the registration of societies.

During the first quarter of 1948 applications have been received and the following societies have been registered:—

1. Naluna Co-operative Society Ltd.
2. Verata Co-operative Society Ltd.
3. Waibula Co-operative Society Ltd.
4. Lomavata Co-operative Society Ltd.
5. Bure Co-operative Society Ltd.
6. Nakorotubu Co-operative Society Ltd.
7. Sigatoka River Planters' Co-operative Society Ltd.

In consultation with District Administration and Fijian Affairs Officers the writer has visited country districts in Tailevu, Ra, Ba, Nadroga–Navosa to meet members of established agricultural clubs and of new societies. These are primarily producer co-operatives, growing crops as rice, bananas, sugar cane, and root crops and keeping stock; and the objects of their association are to carry on co-operative production and marketing, co-operative storekeeping and such other activities as sawing timber, firewood cutting, copra drying and dairying. Some of the societies have provided for limited schemes of credit to members.

—B.E.V.P.

5. PRODUCE

The following is a list of agricultural products of total value £395,919, exported from the Colony during the first quarter 1948.

		£
Arrowroot ..	780 lb	24
Avocado pears	600 ,,	15
Bananas ..	3,274,380 ,,	24,523
Citrus fruits ..	57,240 ,,	720
Coconut meal ..	2,515,520 ,,	13,576
Coconut oil ..	1,147 tons	86,473
Copra	6,399 ,,	266,860
Green ginger ..	48,600 lb	810
Mixed fruits ..	8,220 ,,	96
Peanuts ..	69,100 ,,	2,303
Pineapples ..	720 ,,	8
Rice bran ..	88,200 ,,	490
Taro	3,760 ,,	21

—C.R.V.

PASTURE FERTILIZATION[1]

Local interest in pasture fertilization has centred largely around the use of nitrogen fe tilizer as a means of increasing the carrying capacity of beef fattening paddocks. This interest has been accentuated by present high prices and brisk demand for beef together with scarcity of good fattening lands and unusually poor forage growth due to dry weather in certain sections. Preliminary grazing experiments at the Haleakala Branch Station have shown a growth response to nitrogen fertilizer sufficiently great to indicate the possibility of an economic return from its use for fattening beef animals. In one test with panicum grass, increases in total forage of from 3·5 to six tons per acre were secured from application of 150 pounds of ammonium sulphate. Of special significance to the rancher was the much greater amount of grazeable forage carried over into the dry summer months in the nitrogen plots.

Preliminary experiments on the response of pasture grasses to lime, phosphate, and potash indicate that growth response, if any, is generally limited to the high rainfall areas in Zone D. Previous investigations under our pasture legume project show a general response of most pasture legumes to both lime and phosphorus in Zone D, and chiefly to phosphorus in Zone C. Successful attempts to translate these experimental results to actual ranch conditions have been few, however. Other factors require further investigations, such as the species of legume adapted to each climate, land preparation or sod renovation, and pasture or grazing management.

REFERENCE.

[1] J. C. Ripperton, M. Takahashi, D. L. Van Horn.—"Pasture Fertilization", University of Hawaii Agricultural Experiment Station Biennial Report 1944–46, pp. 20–22.

ECONOMIC BOTANY NOTES . . .

1. DURUKA*—AN EDIBLE FLOWER

Local residents are well aware of and appreciate the culinary value of "duruka" which is the Fijian name for a wild grass or cane. The unopened flowerbud of this plant is commonly called "Fiji asparagus"—and is a seasonal vegetable available during the months of April and May.

The present note records the somewhat unusual confusion which has occurred in the literature dealing with this comparatively common and well known plant.

Seemann, both in *Flora vitiensis*(1) and in his *Mission to Viti* records, with his usual accuracy, "that the young shoots of the 'vaulo'† of Viti Levu, known also, if I am not misinformed, by the names of 'Tui', 'Vico', 'Turuka' and 'Malava' in different districts, after having been boiled, are eaten with taro and yams, but only by Fijians."(2, p. 308). The plant so referred to is a large forest climber easily distinguished by the terminal tendril-like extension of the leaf midribs by which it climbs to the top of the highest trees, the stems often reaching a great length. The flowering shoots are edible but are rarely used.

Nowhere, however, does Seemann refer to the plant known generally as "duruka" which is a true grass, very similar and closely related to sugar cane and which occurs as a cultigen throughout the Colony. Subsequent writers, including John Horne(3) and Wright(4), possibly misled by one of the alternative native names ("turuka") mentioned with reservation by Seemann, identified this latter cultivated plant as *Flagellaria indica*.

In 1938, this obviously incorrect determination was amended in a note in this Journal(5) to *Saccharum spontaneum*, which is another species of wild cane.

The present writer in 1942(6) recorded several varieties of "duruka" but inadvertently referred these to *Erianthus maximus*, which is another near relative. The correct name of the plant is *Saccharum edule* L.

The varieties mentioned were "Babanileka", "Cogecoge", "Kibo", "Leka", "Mimanu", "Taci" and "Vico". The last-named is remarkable in so far as the flower bud continues to develop a normal inflorescence, whereas in all the others, it fails to do so. "Duruka vico", when in flower, is very difficult to distinguish from the closely related grass known as "Vico" which is probably *Erianthus maximus* and which formerly occupied extensive tracts in the river-valleys but which is now not at all common.

The range of distribution of this plant is of interest (Malaya to Solomons and Fiji); but when and by what means it reached Fiji is not known. It is obviously not indigenous; and were it not that older Fijians state that the leaves were used for thatch long before sugar cane was introduced, its distribution and occurrence in Fiji would suggest that it may be of comparatively recent introduction. It is subject to the ravages of the virus disease of sugar cane, known as Fiji disease; and it may thus be an example of an old established plant which has been threatened by a recently introduced disease in the same way as the wild banana or "soaqa,"‡ which has almost succumbed (as a local species) to the banana virus disease "Bunchy-top."

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(4) Wright, C. H.—"A List of Fijian Plant Names", Bull. 10, Dept. of Agric., Fiji, 1918.
(5) Surridge, H. R.—"Duruka" *Agric. Journ.*, Fiji, Vol. 9, No. 1, p. 24, 1938.
(6) Parham, B. E. V.—*Fijian Plant Names*, Bull. 24A, Dept. of Agric., Fiji, 1942.

* *Saccharum edule* L.
† *Flagellaria indica.*
‡ *Musa fehi* Betero.

2. PLANT DISTRIBUTION, JANUARY TO MARCH, 1948

During the first quarter the following distributions of plant material were made from the Department of Agriculture's nursery at Nadururloulou:—

Economic Species—	
Hybrid dwarf coconuts ..	420
Budded citrus trees (15 varieties)	921
Miscellaneous seedlings ..	441
Cuttings	970
Grasses and Legumes—	
Batiki blue grass (plants) ..	16,260
Elephant grass (cuttings) ..	500
Tropical Kudzu (cuttings) ..	1,440
Ornamental Species—	
Rooted plants	422
Cuttings	2,048

Locally, many dairy farmers have obtained supplies of pasture plants from the Department, and have established their own propagation plots. Small holders are particularly interested in the fodder species such as Elephant and Guatemala grasses, and perennial Kaverondo sorghum.

Copra planters have been supplied with grasses and other plants and advised on the most suitable species. An increasing number of farmers have visited the station to inspect the fodder plots and other trials being undertaken, and to discuss their problems. The demand for hybrid coconut seedlings and budded citrus has greatly increased and it has become necessary to extend the nursery area for citrus propagation and to arrange for additional supplies of dwarf coconut seedlings from coconut estates. —B.E.V.P.

EXTRACT FROM "DISCOVERY" NOVEMBER, 1947

"A FUNGICIDAL SPRAY THAT STICKS"

"American research workers have recently developed an entirely new idea in fruit and foliage sprays—an adhesive film based upon organic polysulphides. When sprayed on plants, substances of this type form a transparent, elastic, and web-like film; this film has the fungicidal activity of sulphur, is powerfully adhesive, and resistant to rainfall. Furthermore, when mixed in compound sprays with other spray chemicals, the film-forming capacity is handed on, and otherwise non-persistent chemicals are given a much longer range of effectiveness.

"One company has already marketed a polyethylene polysulphide which is a latex-forming material more fungicidally active than sulphur; moreover, unlike sulphur, it can be used with oils. Tests so far made on a wide variety of horticultural plants have shown that its great toxicity to fungal spores is not associated with other injurious effects. Results so far published, however, suggest that 'p.e.p.s.', the short name conveniently given to the commercial material, is most strikingly effective when used with other toxic substances. After six weeks' weathering, the sulphur left on foliage following an ordinary sulphur spray was 0·19 milligrams per sq. in.; after 'p.e.p.s.' alone, it was 0·54 milligrams per sq. in.; but after 'p.e.p.s.' plus the same amount of sulphur spray it was 1·09 milligrams per sq. in.

"It is suggested that reductions in arsenical dosage of 50 per cent or more will be possible if 'p.e.p.s.' is incorporated in lead arsenate washes; control is likely to be no less effective if not superior. Preliminary experiments have shown, that superior control over pests is given by DDT sprays when 'p.e.p.s.' is added to perform the role of 'sticker'.

"Another field in which this polymeric polysulphide has been promisingly used is in the rot-proofing of bag materials, wood, and tarpaulin."

CHEMISTRY NOTES . . .

"SOIL SCIENCE IN FIJI"—PART III

THE EXAMINATION OF SOILS (CONTINUED)

BY L. E. SMYTHE, M.Sc., A.R.I.C., A.A.C.I.

Soil science embraces generally, three of the most important branches of science—chemistry, physics, and biology. The soil scientist must be conversant with progress in each of these branches in order to examine soils with a view to giving practical aid to the agriculturalist.

Soil chemistry has progressively developed since the significant work of Justius Liebig (1840) and with such development, soil physics and soil microbiology have assumed great importance in any quantitative study of the media in which plants grow.

It has become generally recognized that from the standpoint of plant and animal nutrition, soil tests and the conclusions derived therefrom have revolutionized many agricultural practices. The extent of the help of these soil tests to the agriculturalist will depend on:—

(*a*) accuracy of the soil sampling;
(*b*) experimental accuracy of the soil tests;
(*c*) correct interpretation of the tests and the conversion of findings into practical help.

The soil tests vary from those conducted with rather crude soil test kits designed for use in the field, to those carried out in modern and well-equipped soil laboratories. A well-equipped soil laboratory is able to provide a service to the grower covering any of the soil nutritional problems. In this connexion, it must be realized that while chemical analyses and proper application of the necessary chemicals may correct a nutritional deficiency, such do not overcome faulty cultivation, poor seeds, poor stock, abnormal weather conditions, poor drainage or ravage by insects.

In a given soil investigation, it is the type of soil, considered in relation to the problem itself, which determines the role of soil chemistry, soil physics or soil microbiology. Some of the practical and everyday applications of these sciences include the estimation of available plant nutrients in the soil; mechanical (physical) analyses of the soil to determine the amounts of sand, silt and clay, which in turn indicate the degree of drainage and aeration of the soil; or, investigation of the change of ammonia or organic nitrogen to nitrate nitrogen—this being a biological as well as a chemical change.

The laboratory soil report is nothing more than the balance sheet of the fertility of a soil. The scope of the report depends upon the type of problem to be investigated and generally most soil reports supply the following information:—

1. Official soil number, references, and history of the sample.

2. *Soil Type.*—The soil type is of great importance in that it represents a variety or type of soil which has been classified with regard to texture and soil profile, and for which full details regarding nutrient status, physical properties and distribution, are available. The appreciation of the significance of particular soil types is a matter of experience and is not beyond the grasp of any agriculturalist. Indeed, it is quite a common occurrence to hear farmers overseas speaking of say, Manawatu silt loam or Wentworth clay loam, and each is more than just a name to the practical farmers of these areas.

3. *Mechanical Analysis.*—The figures for mechanical analysis quoted in a laboratory report require careful interpretation. Usually, these figures are converted into everyday language by the extension officer, or in correspondence. The following require amplification:—

(*a*) Per cent Fine Earth—This indicates the percentage of soil in the soil sample with particles less than 2 m.m. (0·08") in diameter. The percentage is expressed on a weight basis of the air dry soil sample. The percentage of fine earth is of importance

in cultivation and soil management generally. For example, a gravelly loam is not managed in the same manner as a sandy loam. Sometimes, the percentages of stones, gravel; particles $\prec$ 2"; particles $\prec \frac{1}{2}$"; and particles $\prec \frac{3}{16}$" are given.

(*b*) Per cent Coarse Sand—sand particles 2·0—0·2 m.m. in diameter.

(*c*) Per cent Fine Sand—sand particles 0·2—0·02 m.m. in diameter.

(*d*) Per cent Silt—particles 0·02—0·002 m.m. in diameter.

(*e*) Per cent Clay—particles less than 0·002 m.m. in diameter.

The proportions of (*b*), (*c*), (*d*) and (*e*) in a soil give rise to the texture of a soil. Generally, tropical soils have a small proportion of silt which gives "silkiness" and "lightness" to a soil. Clay is "sticky" and gives rise to heavier and poorly drained soils. Sand gives "grittiness" to a soil and is condusive to improved mechanical condition, aeration and drainage. Naturally when clay, silt and sand are combined in a soil, it is the proportion of each which is important.

4. *pH.*—pH espresses the acidity or alkalinity of, in this case the soil. A soil with a pH of 7·0 is neutral, that is, neither acid nor alkaline. The following may be helpful:—

Soils with—
pH 4— 5 = very acid.
pH 5— 6 = moderately acid.
pH 6— 7 = slightly acid.
pH 7— 8 = slightly alkaline.
pH 8— 9 = moderately to strongly alkaline.
pH 9—10 = very strongly alkaline.

The pH of a soil is of the utmost importance as it indicates the conditions under which the plant may absorb essential nutrients from the soil. For example in Fiji, the majority of soils have a pH of between 4·5 and 6·0. It is an established fact that the two of the most important nutrients in the soil (phosphorus and potassium) are not readily available to the plant under these conditions of acidity. The answer? Liming the soil, for example with coral sand; the amount of lime to be added, depending upon the recommendations of the soil scientist and based on practical experience and laboratory findings. Liming then, raises the pH of a soil to a convenient and predetermined point and the soil is then in a better position to give up essential nutrients. Most vegetable crops favour a pH of 6·5, but this varies. For example: potatoes 5·0—5·5, tomatoes 6·0—6·5, lettuce 6·5—6·8 and so on. Too alkaline a condition of the soil is just as harmful to the plant as too acid a condition. Various measures may be taken to correct excessive alkalinity which is an uncommon occurrence in Fiji.

5. *Total Nitrogen.*—Total nitrogen is expressed as a percentage of the air dry soil and includes organic and inorganic forms of nitrogen. The total nitrogen content of a soil is related, in the majority of cases, to the organic matter (humus) content of the soil. The following are approximations:—

Nitrogen content = 4—5 per cent of organic matter content,
and Carbon x 1·7 = organic matter content.

Modern farming practices are nitrogen depleting and the plant cell requires nitrogen for amino acids, which in turn are converted into protein. Man and animals require protein, so it is unnecessary to stress the importance of soil nitrogen. The total nitrogen in soils ranges from a few parts per million to, in most cases, no more than $\frac{1}{2}$ per cent. The following may be helpful:—

Per cent Total Nitrogen.	Conclusion.
less than 0·1	poor
0·1—0·2	medium
0·2—0·3	good
more than 0·3	excellent

Some forms of nitrogen in the soil are more readily available to the plant than other forms. Special investigations may require the detection and determination of such forms. Nitrogen fixing bacteria also play an important part in the nitrogen status of the soil and more will be said of this in a future article.

6. *Organic Carbon.*—The organic carbon content of a soil gives us an idea of the amount of organic matter in the soil. Organic matter (or humus) improves the tilth and water holding capacity of a soil and aids in the solution of essential nutrients. Humus also plays a very important part in erosion control, soil conservation, and the life cycle of soil organisms. It may be safely said that every agricultural soil must have an adequate organic carbon content. The organic carbon content of a soil is adequate, when as below:—

Per cent Organic Carbon.	Texture.
0·9 or more	sands
1·0 ,,	fine sands
1·2 ,,	sandy loams
2·0 ,,	loams and silt loams
2·3 ,,	clay loams

NOTE.—Some exceptional soils (peat soils) have an organic carbon content of up to 50 per cent. As mentioned previously:—

Organic carbon x 1·7 = organic matter content (approximately).

7. *Potash.*—The potash (K_2O) content of a soil may be expressed in several different ways:—

(*a*) The percentage total potash, based on air-dry soil.

(*b*) The percentage "available" potash, based on air-dry soil. This is the percentage K_2O which may be taken from the soil by a chemical extracting solution, so composed as to closely imitate the plant's mode of extracting nutrients from the soil.

(*c*) Exchangeable potassium expressed in milliequivalents per cent (m.e. per cent). This value is very useful in studies of the nutritive status of soils and represents the amount of potassium in the soil colloid complex, which may be replaced by another ion (e.g. ammonium ion, NH_4^+). The exchangeable potassium is considered in the light of other exchange values (such as total exchange capacity) of the soil.

Generally the percentage of available potash is quoted, as total potash is of limited value in nutritive studies. The table below generally illustrates the conclusions which may be drawn from the analyses carried out in our laboratories(1).

Per cent available K_2O.	p.p.m. available K_2O.	Conclusion.
less than 0·005	less than 50	very poor
0·005—0·010	50—100	poor—medium
0·010—0·020	100—200	medium—good
0·020—0·030	200—300	good–very good
more than 0·030	more than 300	very high

8. *Phosphate.*—The phosphate content of a soil may be expressed as:—

(*a*) the percentage total phosphorus pentoxide (P_2O_5) based on the air-dry soil; or

(*b*) the percentage "available" phosphorus pentoxide (P_2O_5) based on the air-dry soil.

The total phosphorus content of a soil is of great value but values so obtained are not easy to interpret when considering for example, fertilizer requirements. The consensus of opinion now is, that the percentage of available phosphorus is more useful for diagnostic and nutritive studies. There are several chemical methods for the estimation of available phosphorus in a soil, and each gives a slightly different result. The most promising of these methods(2) is in use by our laboratories.

Generally the results obtained for available phosphate may be interpreted as follows:—

Per cent available P_2O_5.	p.p.m. available P_2O_5.	Conclusion.
less than 0·001	less than 10	very poor
0·001—0·004	10—40	poor
0·004—0·006	40—60	fair
0·006—0·010	60—100	good
more than 0·010	more than 100	very good

Other analyses given in the soil report may include: iron (Fe_2O_3), alumina (Al_2O_3), silica (SiO_2), lime (CaO), magnesium oxide (MgO), sodium oxide (Na_2O), manganese oxide (MnO), sulphur (S), fluorine (F), chloride (Cl^-), loss on ignition, total exchange capacity, exchangeable cations, exchangeable hydrogen, specific gravity of soil and clay particles, water stable aggregates, pore size distribution, freezing point, moisture

equivalent, sticky point, permanent wilting point, soil permeability or infiltration, soil gases (CO_2, O_2, N_2, CH_4, etc.), and trace elements (boron, cobalt, copper, molybdenum, selenium, zinc etc.). The number of such analyses undertaken will depend upon the soil and the problem or problems which it is desired to investigate.

In order to illustrate the time required for the accurate analysis of a soil sample we may consider the examinations outlined under 1 to 8 above. It is estimated, that excluding the time taken in sampling, compiling the report, the cleaning and setting up of apparatus, the preparation of chemicals, etc.; that sixteen man hours of work are required for the analysis of one soil sample. It is possible to reduce this figure in an institution employing many chemists. In this case each worker is allotted one particular estimation and he may carry out several at once, thus reducing the time spent on each sample.

The laboratory report very often gives recommendations as to the fertilizer requirements of a soil. Such recommendations are not only based on the chemical analysis of the particular soil but also on statistically designed fertilizer trials carried out by the agronomist. Trials under field conditions are most valuable and in any agricultural institution, the need for an agronomist is a real one.

Should a laboratory report indicate the fertilizer requirements as one particular form of fertilizer, the farmer may require to convert such figures into the equivalent of other forms. For example phosphate fertilizers may be reckoned on the basis of their:

(*a*) phosphorus (P) content; or
(*b*) phosphoric acid (P_2O_5) content.

The table of factors given below will be found useful for such conversations.

FACTORS FOR CHANGING FERTILIZER ELEMENTS TO COMPOUNDS AND COMPOUNDS TO ELEMENTS[3].

Nitrogen (N) $\times$ 1·215 = Ammonia (NH_3); and $NH_3 \times 0{\cdot}823 = N$.

Phosphorus (P) $\times$ 2·288 = Phosphoric Acid (P_2O_5); and $P_2O_5 \times 0{\cdot}437 = P$.

Potassium (K) $\times$ 1·204 = Potash K_2O); and $K_2O \times 0{\cdot}830 = K$.

Calcium (Ca) $\times$ 0·399 = Lime (CaO); and $CaO \times 0{\cdot}715 = Ca$.

Magnesium (Mg) $\times$ 1·658 = Magnesia (MgO); and $MgO \times 0{\cdot}608 = Mg$.

Sulphur (S) $\times$ 2·500 = Sulphuric acid (SO_3); and $SO_3 \times 0{\cdot}400 = S$.

Calcium (Ca) $\times$ 2·496 = Calcium carbonate ($CaCO_3$); and $CaCO_3 \times 1{\cdot}784 = CaO$.

Magnesium (Mg) $\times$ 4·112 = Calcium carbonate ($CaCO_3$); and $MgO \times 2{\cdot}480 = CaCO_3$.

NOTE.—Calcium, magnesium and sulphur are included, as they are of importance in controlling the soil reaction. In addition the equivalents of lime, magnesia, and calcium carbonate may be obtained from this table; this is useful when dolomite ($CaCO_3$. $MgCO_3$) is used for controlling the soil reaction.

In the manner outlined in this article, soil science is able to help the farmer and it is the intelligent farmer who makes the best possible use of all the scientific information that is available. Such information, coupled with practical experience, makes him an efficient farmer successful in his business.

There is as well, the national point of view and it must be recognized that quite apart from any success or failure of the individual, it is of great national importance that good soil should be protected against erosion and undue depletion of its food reserves, that fertilizers and manures should be employed correctly, and that every soil should grow the range of crops for which it is best suited; due regard having been paid to such factors as climate, transport and the economics of production.

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VETERINARY NOTES . . .

1. COMMON COMPLAINTS OF DOGS IN FIJI

I. DISTEMPER

By K. J. GARNETT, B.V.Sc.

This is the first of a series of articles which, because of the present shortage of Veterinary staff, are intended to give dog owners some idea of the complaints likely to be seen in their dogs, and by being familiar with such, to take measures to prevent or minimise the effects of the complaints described. The first article deals with that scourge of dogdom, distemper.

The world over, one of the most common diseases in dogs under two years is canine distemper. The disease is caused by a specific virus which has an incubation period of up to three weeks, and, following on its establishment, it is closely followed by secondary bacterial invaders. Broadly speaking, the disease can occur in five different forms which may be seen singly, or in any combination including all five forms together.

1. There is a simple or benign form in which there is catarrh of the nasal mucous membranes, conjunctivæ, and in some cases the mucous membrane of the alimentary tract is affected. This gives rise to the well known discharge from the eyes and nose, and a mild digestive upset is often seen at the same time. Actually, before the above symptoms are seen there is an initial temperature rise of up to 104 F. which may last 24 to 48 hours but is usually not noticed by the owner. About 48 hours later there is a second rise in temperature, along with which the above symptoms are seen. The dog is noticed to the somewhat dull and usually goes off its food.

2. The skin form is characterized by the formation of small yellow pustules on the hairless parts of the abdomen, inside of the thighs, and inside of the forelegs near the chest. These commence as small red spots or " pimples " and later become filled with yellowish or greenish pus. When these burst, they usually form sticky crusts.

3. Respiratory form. This is characterized by a bronchitis or broncho-pneumonia in which the virus is associated with a secondary invasion of bacterial organisms such as *B. bronchiseptica*, various types of *Corynebacteria* and sometimes the common *Streptococci* and *Staphylococci*. Associated with this form are the raised temperature and all the typical signs of pneumonia, e.g. rapid shallow breathing, chest noises or *râles*, discharges from the eyes and nose etc. There is often a slimy deposit over the lining of the mouth and on the teeth.

4. Abdominal form. This is essentially a gastro-enteritis with diarrhœa and often accompanied by vomition. This causes considerable loss of body fluids, and since pups will not usually eat or drink much, there is considerable wasting or loss of condition if the above symptoms are severe. There may also be mouth lesions in the form of small ulcers in the mucous membrane, and a film over the teeth is also commonly seen. The breath is usually somewhat fœtid.

5. Nervous form. All forms dealt with above usually respond quite readily to treatment if this is commenced in time, but if the virus localizes in the nervous system as it sometimes does, a permanent injury which usually takes the form of a partial or complete paralysis may result. Nervous symptoms may be seen early in the course of the disease, or may appear for the first time, a month or so after the dog appears to have completely recovered from the other symptoms. These nervous symptoms may be seen as epileptiform convulsions in which the dog goes stiff all over and the head is usually retracted. The pupils are dilated and there is usually loss of consciousness. The attack lasts from a half to one minute, and frothing at the mouth is common. Following the contractions, there is often a galloping or paddling movement of the legs with the animal still lying on its side.

Instead of the convulsions described, chorea or twitching of certain groups of muscles is seen so that regular movement is noticed in part of the neck, head or perhaps limbs, depending on the site attacked.

Both chorea and convulsions may appear early in the course of the disease, or, as mentioned, after all other symptoms have disappeared. Chorea may persist and affect the dog for the rest of its life. Also commonly seen is a weakness in one or both hind legs or some other part of the body which may result in a complete or partial paralysis of the region.

In Fiji in 1945, it was noticed that on many occasions, the first symptoms seen were of the nervous form and quite frequently, dogs died in two or three days without showing any of the other more typical signs of distemper. If the dog survived for a longer period, these typical symptoms were seen, but in nearly all cases, a very acute course was followed with mortality over 80 per cent. The few dogs that did recover from the initial attack were usually left with some permanent nervous disorder. Fortunately, this acute syndrome waned in 1946.

To sum up, the following points will assist in establishing an early diagnosis:—

(*a*) Age of dog under two years.

(*b*) Raised temperature. A dog's temperature is taken by inserting an ordinary clinical thermometer into the rectum. The normal temperature for a dog is approximately 101·5 F., but if the temperature is 103 or over it indicates that a fever is present.

(*c*) Yellowish discharge from eyes and nose.

(*d*) Small yellow pustules on the belly.

(*e*) Known contact with other pups which have been diagnosed as suffering from distemper.

Once diagnosis has been established, the dog should be isolated and treatment commenced as soon as possible. If a Veterinarian cannot be contacted, but sulphonamide drugs are available, they should be used as follows:—

Give the dog one half gramme tablet for every seven pounds of its weight for the first three days. Then reduce this dose slightly over the next two days. For example, a forty pound dog requires six tablets per day for the first three days, and since these must be spread over the day, it is recommended that they be administered as follows:—

Two tablets three times per day for the first three days.

Two tablets twice per day for the next two days.

Since the dose is determined by the weight of the dog, it should be scaled down for smaller dogs, e.g. a thirty pound dog (a little larger than a Fox Terrier requires):

One tablet four times per day for the first three days.

One tablet three times per day for the next two days.

It is important that the drug should be given regularly once treatment has commenced, since the action of sulpha drugs depends on maintaining a concentration in the blood stream. Best results have been obtained by the Veterinary Division using either Sulphathiazole or Sulphanilamide, but any of the systemic sulphonamides are satisfactory, although nausea is sometimes noticed when Sulphapyridine is used. In cases where the abdominal form is marked and there is severe diarrhœa, it is advisable to use one of the non-systemic drugs such as Sulphaguanidine in the same doses as above.

In order to get a rough idea of the weight of different types of dogs, the following amended table from Hoare is appended.

	lb.
Toy Terriers, Sydney Silkies, etc.	5— 12
Fox Terriers, Scotties, etc. ..	18— 25
Bulldogs and Spaniels	40— 45
Bull Terriers, Collies, Greyhounds	50— 65
Alsatians	60— 80
Great Danes, Mastiffs	up to 120

The use of drugs alone is of little use unless followed by good nursing. Affected dogs should be kept out of draughts, preferably on a clean bag in a large box or corner of the building, and under no circumstances should they be allowed to get wet. They should be fed on light nourishing foods such as lightly cooked mince, rice, bread or

potatoes mixed with gravy. Bread, breakfast cereals or arrowroot may be soaked in milk, and if the dog is low, egg flips to which a small quantity of brandy has been added will be helpful. A dish of clean water should always be available.

If there has been very much discharge from the eyes, they often become "glued up" and should be bathed as often as necessary with a weak solution of boracic acid. This is well followed by the addition of one or two drops of a seven per cent solution of Arvitin, Sylvol or Argyrol into each eye.

Finally a word on serums and vaccines. If available, hyperimmune serum is of considerable assistance in combating the disease if injected at the onset of the condition. Dogs can be actively immunised against distemper by the use of various vaccines, but unfortunately, these do not keep long, and because of delays in their delivery from overseas, coupled with the fact that proper isolation kennels are not at the disposal of the Veterinary staff, such vaccination is no longer carried out in Fiji. However, multiple vaccines to combat the secondary bacterial invaders are available, and these, along with the sulpha drugs and the serum mentioned above give us fairly adequate weapons to combat the disease if an accurate and early diagnosis is established.

(In the next article, the various types of intestinal worms and heartworm will be discussed).

2. FACTS ABOUT THE FIJI S.P.C.A.

By D. J. G. DAVIES, DIP. C.A.C.N.Z.

Introduction.

The Fiji S.P.C.A. can during its short life, certainly claim outstanding achievements towards its ultimate objects, which in its Constitution read in part: "The objects of the Society shall be the prevention of cruelty to all manner of animal, bird and fish life within the Colony of Fiji and the propagation by teaching and instruction among the people of the Colony to bring about that end. The Society may, for the purposes of facilitating its work, promote the improvement of the laws of the Colony relating to the prevention and punishment of acts of cruelty and control, preservation and destruction, of any form of life, and actively participate in the enforcement of such laws."

The Society was formed with Headquarters at Lautoka on the 6th October, 1946. The membership is unlimited by number, age or race of people with a fee of five shillings annually or five pounds life membership.

Humane Education.

Education work has been carried out (*a*) amongst children, and (*b*) amongst adults.

(*a*) By means of Junior Divisions, which specially appeal to those between the ages of eight and eighteen years. Members are expected to try to do one "good turn" to an animal each day. There is no subscription, but a badge may be purchased for threepence. Twenty of these Divisions are already operating with gratifying results. These include Fijian, European, Indian and Chinese Schools.

The children receive talks, read their special animal pamphlets, write essays, attend pet shows where they have to show that they understand all about the care and feeding of their pets.

(*b*) Through the R.S.P.C.A.'s various pamphlets and magazines. By personal consultation and advice from the Society's honorary workers.

A permanent Animal Clinic with attendant has been established at Lautoka incorporating the most modern and painless methods of destruction for sick and unwanted small animals, free consultation and advice to the public on all animal problems. By courtesy of the Department of Agriculture the Veterinary Officer Western has regular clinic days.

A lethal chamber built into the Society's vehicle, a complete first-aid kit, chloroform chambers, ingenious traps and other methods for handling wild dogs, all point to the extensive research and progressive

thought that has been devoted to the particular " small animal " problems in Fiji.

House-to-house inspection, supervision at markets, giving friendly advice, cautioning where necessary, and if need be, prosecuting offenders are some of the regular duties carried out by the Society.

OBTAINING FRESH LEGISLATION.

Immediately upon formation, the Society presented to government certain suggestions, prominent among which was a method of breeding control as an alternative to the inhumane practice of the poisoning of unwanted and stray dogs.

The recently revised Dog Ordinance is a direct result of this representation, as is also the approval by Government for the appointment of a permanent dog-catcher with mobile lethal chamber for the collection of surplus and unwanted dogs and cats.

The Society is not satisfied with the existing laws under the Penal Code relating to cruelty to animals, and is making application for the revision of an archaic law.

BRANCHES.

Branches have been formed at Sigatoka and Ba and there are indications that Nadi will shortly follow suit.

PARTICULAR PROBLEMS.

The fundamental policy of all Animal Societies is universal. In Fiji peculiar problems present themselves, the most outstanding of which is that of the so-called " jungle dog ".

Undoubtedly this menace has been the direct result of overbreeding in urban areas, and the consequent abandonment in rural areas of those surplus to requirements to be left to fend for themselves.

Contending that no Society for the prevention of cruelty could pretend to operate while starving animals were allowed to breed in thousands and exist under diseased and starved conditions, the Fiji S.P.C.A. decided to tackle this problem at its source, commencing with the township of Lautoka. During the first year of its experiment approximately 1,000 diseased and starving bitches were painlessly lethalised. These thousand unfortunate animals represented at a conservative estimate, a potential increase of 12,000 dogs in the following year.

It has been proved beyond all doubt that this method of breeding control has been received with approbation by all sections of the community. Even those with phychological belief against the taking of life realize that the increase of such animals has reached unmanageable proportions.

It has been necessary that the Society make practicable its suggested control of breeding by demonstrating its methods, but the Society is emphatic in its claim that the unregistered and stray dog is the responsibility of the Government. With the efficient organizing of the proposed permanent mobile lethal unit and dog-catcher, this problem which has for so long caused " headaches " to various Government Departments, can be reduced to a minimum. The allocation of this unit for certain periods to each district and the co-opting of police to assist appears to be a logical argument.

It is obvious that the increased registration fee for bitches will result in the surrender of many animals and unless some provision is made for collection, these unfortunate creatures will suffer abandonment and quickly add to the already serious number of " jungle dogs ".

LETHALIZATION.

With the realization that in order to further the ultimate aims of the Society it was, under present conditions, as a dog and cat extermination body that it must first function, extensive research and informamation was essential to provide the most efficient means of destruction.

These particulars were sought from all parts of the world, including England, Germany, Australia and China.

Each method was carefully investigated and it has been proved that carbon monoxide gas (producing unconsciousness within three minutes) is by far the most rapid and painless for adult dogs and cats, whilst for puppies and kittens the universally recommended use of chloroform is most satisfactory.

Injections of saline solution are certainly quick and painless but this method requires

two skilled operatives, which are not always readily available.

FINANCIAL.

This vital factor has been generously contributed to by Government grants which have made possible extension of the Society's activities.

Included in its functions, organized for raising funds, was the Gymkhana and procession of floats held at Lautoka last October, and attended by 3,000 people.

Following the practice of Animal Societies throughout the world, the Society has now in hand arrangements for a "Be Kind to Animals" week to be held in the last week of July. Important contributions to this week's activities will be by the 20 Junior Divisions at Lautoka, in the form of a concert, essay and poster competitions, street sale of badges, etc.

CONCLUSIONS.

Such a record, by an organization long over-due in Fiji, is surely deserving of more active and enthusiastic support by the public throughout the Colony.

The Society points out that the animals are essentially the responsibility of the public in any country, and whilst Government support and co-operation is gratifying and necessary, the public must accept the fact that without their individual interest and assistance neither the work of the Society nor legislation by Government can be wholly effective.

This long neglected cause needs sincere concerted effort by all, and the good example now set should be extended and amplified.

UTILIZATION OF TOWN AND COUNTRY WASTES, GARBAGE AND SEWAGE

Pages 38–39.

Most towns in New Zealand have sewage schemes in existence, and the main question is how to modify their schemes to operate them as sewage utilization schemes instead of sewage disposal schemes. There are no outstanding difficulties. Methods of disposal in New Zealand to-day may be classed under the following heads:—

1. Discharge of crude or untreated sewage into the sea.

2. Treatment of sewage in septic tanks and liquefying tanks such as Imhoff tank and discharge of the effluent into the sea or rivers—likewise the sludge.

3. Similar to (2) but with filter beds to purify the effluent before discharge.

4. Sedimentation and irrigating the land with the effluent (sewage farming).

In the case of class (1) schemes, it would be necessary to construct new tanks to trap the sludge. In the case of the other three clauses, existing tanks will be suitable. All that is needed is the installation of sludge pumps to pump the sludge from the tanks to the composting bays.

The effluent could, of course, be discharged as it is now, and in many cases this would be found the most economical. In places where the effluent is likely to cause pollution or where it is desired to obtain from the effluent the remaining valuable organic, and inorganic, matter in suspension or solution, two methods present themselves.

In the first the tank treatment would be that known as the "Activated Sludge" Process in which 90 per cent of the suspended solids and 90 per cent of the organic matter is recovered.

In the second, the effluent from ordinary settling tanks could be passed into lakes where water hyacinth is grown. Practically the whole of the organic and inorganic solids are absorbed by the water hyacinth, which can be cut monthly and composed with the sludge and garbage. This triple method of utilization was propounded by Mr. T. A. F. Stone, retired engineer of Auckland, and submitted to Sir Albert Howard. The latter has had some large-scale experiments made in South Africa during the past two years and recently wrote:—

"As I expected, the water hyacinth will remove most of the dissolved plant food materials in solution in sewage effluent and will trap these on the way to rivers or the sea and so provide vast quantities of compostable material.

" The main facts are these. I will quote averages only and will not deal with maximum or minimum figures.

"An acre of water under water hyacinth yields 96 tons per acre. The rate of reproduction is 100 per cent per month. One acre will yield 66 tons of dry matter per year

" The crop value of one acre per annum is as follows:—

Nitrogen in lb ..	2,415	£177	6	0
Phosphoric Oxide in lb	1,917	38	4	0
Potash in lb	3,300	59	11	0
Total		£275	1	0

"A city of 200,000 people would require an area of water hyacinth of about 900 acres, which would yield 1397·9 tons of organic nitrogen and a yearly income of £205,000 in nitrogen values only. Add the phosphoric oxide and potash values and we have a potential source of new revenue from 200,000 people of £341,800. These figures take no account of humus values, lime or other elements present in the plant."

* * *

Page 20. Part 4—Food or Famine?

K. B. Cumberland in his book, " Soil Erosion in New Zealand " says:—

" Soil conservation is not only technically possible, but economically desirable and socially imperative. Productive soil is vanishing the world over. There are in the world two food-producing acres per person. Some countries have less than one *per capita*. That one is often of low fertility, or is being maltreated and eroded. Yet nutritionists say that a minimum of two and a half acres *per capita* of good land are necessary to produce a minimum adequate diet."

" The difference between the current and the desirable averages is half an acre. This has to be multiplied by 2,000,000,000. This means that either 1,000,000,000 new acres must be brought into food production or else the productivity of the 4,000,000,000 acres now under grass or food crops must be stepped up by 25 per cent. The latter seems more feasable."

Here is a terribly grave problem. Already the world is short of 1,000,000,000 acres of fertile soil. This extra amount is needed now—to-day, to maintain the minimum nutrition needs of humanity as specified by Sir John Boyd Orr, Director-General of the Food and Agricultural Organization of U.N.O. But the world's population is increasing and the area of fertile soil is decreasing at an alarming rate. In the 20 years, 1914 to 1934 the total area decreased by 1,000,000 square miles (640,000,000 acres) through erosion alone. This will give you some idea of the rate at which the world is losing its precious fertile soil. Ten years ago how many of us were aware of the erosion problem, yet to-day how many of us are unaware of it?

Is not the position regarding food production the same? A few years ago we were unaware of any shortages. True, we did burn surplus food in one part of the world whilst millions were starving in other parts of the world. But that was the result of a faulty economic system, not an actual shortage of the total food available. To-day there is an absolute shortage of food. Here is an extract from a letter from Dr. Graham Andrew, one of Australia's medical representatives on U.N.R.R.A.:—

" *Recent reliable figures indicate that* 800,000,000 *of the world's population are short of food and that the terrifying figure of* 300,000,000 *are living on a diet of* 1,000 *calories per day or less.*"

LIBRARY NOTES . . .

1. RECENT AGRICULTURAL PUBLICATIONS

At the request of the Agricultural Advisory Council, it is proposed to publish regularly a list of current publications and articles which are considered likely to be of interest to local readers. These are obtainable for perusal on application to the Librarian, Department of Agriculture, Suva.

1. Ware, F.—"Indian Cattle in the U.S.A." *Empire Journal of Experimental Agriculture*, 15, 60, 1947.

Cross breeding work which is being carried out in the Southern States between Brahman (Zebu) cattle and such breeds as Hereford, Abderdeen Angus, Shorthorn and the so-called native cow.

2. Stony, C. G.—"Tractor Costs." *Queensland Agric. Jour.* 65, 4, 228—1947.

A simple straight-forward statement of two methods of costing on (*a*) daily, and (*b*) annual basis.

3. Hopkins, D. P.—"Crops without Soil" *Discovery* reprinted in *Indian Farming* Vol. 8, No. 4—1947.

4. "Advances in Grassland Husbandry and Fodder Production." *Second Symposium Bull.* 38—Imperial Bureau of Pastures and Field Crops—May 1947.

Of the 15 authoritative articles in this publication, the following are of special interest to local readers as dealing with various aspects of tropical and subtropical grassland husbandry and with pasture species and fodder plants commonly met with in the Colony.

(1) "Grass Productivity Studies in a Tropical Lowland" is a contribution from the Bureau of Tropical Agriculture, South Johnstone, Queensland, and deals with the effect of season and frequency of cutting on productivity, variations in yield and protein content as influenced by seasonal productivity and cutting frequency. The following species which occur in Fiji are dealt with: Guinea, Molasses, Woolly Finger, Rhodes and Summer grasses.

(2) "Pastures and Fodder Plants in Sierra Leone" discusses the prospects of improved management of natural fodder grasslands. It is recommended that 7·5 to 37·5 acres of natural grassland are necessary per cow. The status of artificial pastures and cut fodder, the importance of pastures for control of soil erosion and the essential requirements of a temporary or permanent pasture are discussed.

(3) "Weeds in Fiji" is a summary of the report (C.P. No. 35 of 1945) of the local Noxious Weed Committee which is recorded as "probably one of the first serious attempts to deal with the weed problem in a British tropical Dependency."

5. "Cowshed and Dairy Construction" by F. Megginson, *Journal of Jamaican Agricultural Society*. Jan.-Mar. 1947, p. 22.

6. "Breeding Livestock adapted to Unfavourable Environments"—R. W. Phillips. *F.A.O. Agricultural Studies No.* 1.

2. THE IMPERIAL AGRICULTURAL BUREAUX

CHANGE OF NAME.

The Executive Council of the Imperial Agricultural Bureaux has decided to change the name "Imperial Agricultural Bureaux" to "Commonwealth Agricultural Bureaux".

This change has been made because the Executive Council feels that the use of the word "Commonwealth" rather than "Imperial" is more in keeping with modern trends. The change will take effect from 1st January, 1948.

The Imperial Agricultural Bureaux were founded in 1929 by agreement among the Governments of the British Commonwealth and Empire. Each co-operating Government appoints its own representative on the Executive Council which is responsible to all the co-operating Governments jointly. The organization is financed by the co-operating Governments in agreed proportions. The work of the organization is reviewed by successive Imperial Conferences.

The main function of the organization is to act as an effective clearing house for the interchange of information of value to research workers in agricultural science and forestry throughout the various parts of the Commonwealth and Empire.

The organization which the Executive Council controls consists of the Institute of Entomology, the Mycological Institute, the Bureaux of Soil Science, Animal Health, Animal Nutrition, Plant Breeding and Genetics, Pastures and Field Crops, Horticulture and Plantation Crops, Animal Breeding and Genetics, Agricultural Parasitology (Helminthology), Forestry, Dairy Science, Biological Control and the South American Potato Collection.

3. RECENT LEGISLATION

The maximum retail prices of vegetables on Ovalau were fixed by Price Control (No. 6) Order, made at Suva on 19th March, 1948.

An Ordinance (No. 2 of 1948) to amend the Dogs Ordinance was passed enabling the Governor to appoint officers of the Fiji S.P.C.A. to be inspectors; increasing the licence fees for unsterilized bitches; enabling diseased or neglected dogs found at large in settled areas to be seized and impounded; and effecting certain other minor amendments to the Ordinance. The Amending Ordinance was enacted on 24th March, 1948.

Under the Markets Ordinance (Cap. 70) markets have been established at Nadi, and Sigatoka, the Notices to have effect from the 5th and 13th December, 1947, respectively.

NUT GRASS CONTROL[1]

The control of nut grass on cultivated land remains a very difficult problem and in many circumstances it is impossible to do more than hold the weed from spreading. Experimental work now in progress suggests that both a new type of weedkiller (the hormone type) and certain soil fumigants may be effective in destroying nut grass, but at the moment no definite recommendations for their use can be made. With a weed such as nut grass whose tubers may lie dormant in the ground for a long period, it is impossible to finalize control trials in a single season, and probably a further year or two years' investigation will be necessary to work out an economical treatment.

The following measures have been used with some degree of success against nut grass, and individual farmers may find that one or more of them may be applied to their particular conditions. It might be mentioned here that the parasitic insects of nut grass in Australia do not appear to exercise any great degree of control of the pest and entomologists do not consider it worth while introducing them to new districts.

CHEMICAL METHODS.

The common weedkillers such as arsenicals and chlorates effect some "kill" nut grass when applied as sprays, but movement of the poison throughout the underground system of tubers is usually not sufficiently thorough to thin the weed out to very small proportions.

Chemicals which sterilize the soil will, of course, destroy nut grass if they are applied in quantities sufficiently large to ensure sterilization to a depth of 18 inches or more. Thorough sterilization will throw the treated land out of cultivation for upwards of a year, the period depending on the chemical used, the soil type, and the rainfall experienced. Soil structure may be adversely affected. Consequently, it may be inadvisable to use soil sterilants except where only small patches are infested. Sodium chlorate at the rate of at least 4 cwt. per acre and ordinary salt (such as coarse butcher's salt or waste salt from hide stores) at the rate of at least five tons per acre can be used as soil sterilants.

The hormone type of weed killer mentioned above is on the market in Queensland

under the trade names of "Methoxone", "2, 4-Diweed", and "Weedone". The basis of weedkillers of this type is 2, 4-dichlorophenoxyacetic acid. Farmers wishing to test this type of weedkiller should at each spraying apply the equivalent of at least 2 lb of the active constituent per acre. This represents a minimum cost of £2 per acre per spraying. The weed should be sprayed when in the young and actively growing condition and not during the winter months.

Some farmers are under the impression that hormone-type weedkillers can be used against nut grass in growing vegetable crops. This is incorrect. So far as is known, only true grasses and cereals crops are not seriously affected by amounts of the hormone-type of weedkiller necessary to harm nut grass.

CULTURAL METHODS.

One method of tackling nut grass is to cultivate at frequent intervals in order to destroy the young leaves before they can manufacture foodstuffs and supply them to the underground storage organs—the tubers. The success of this method depends on regular cultivation. If, owing to a long period of wet weather, cultivation is long delayed, the tubers will have a chance to recover from the effects of any previous regular cultivations. Cultivation seldom eradicates nut grass from a paddock, but if it can be carried out thoroughly—say at fortnightly intervals over a year or two—it will probably enable crops to be grown for three or four years without severe competition from the weed.

Care must be taken to avoid spreading nut grass from paddock to paddock on the cultivating implements.

Infested paddocks on which it is costly to grow row crops because of the large amount of tillage necessary would in many instances be better devoted to a strongly competitive semi-permanent crop such as lucerne or pasture. Such crops if properly managed tend to weaken the stand of nut grass and may permit a rotation of annual row crops and semi-permanent crops to be operated.

USE OF LIVESTOCK.

Pigs are fond of the tubers of nut grass and if they are confined on an infested patch for a reasonable length of time and permitted to root in the soil they will reduce the infestation considerably.

Poultry can also be used to reduce nut grass infestation. If run on a restricted area so that all shoots are plucked as soon as they appear above ground, fowls will very largely clean an area within a couple of years.

FLAMING.

It is claimed by some American authorities that frequent flamings will destroy nut grass. This method of treatment is now under test in Queensland. Farmers with a flamethrower or a weed burner attachment may find it worth while to carry out tests on their properties.

REFERENCE.

(1) Queensland Producer, Nov. 1947.